

Claims

What is claimed is:

1. In a connection arrangement including a plurality of electronic devices, wherein information can be exchanged among the plurality of electronic devices through
5 a plurality of communication links between the electronic devices, at least one of the electronic devices being configurable for communicating with a data source, a method for presenting a multi-channel message originating from the data source, the multi-channel message comprising a plurality of components, the method comprising the steps of:

allocating each of at least a portion of the plurality of components in the
10 multi-channel message to at least one electronic device for presentation to a user;

for each allocated component, determining possible communication paths between the data source and the at least one electronic device allocated to the corresponding component;

selecting, based at least in part on one or more selection criteria, at least
15 one of the possible communication paths for each of the allocated components, each of the selected communication paths representing an optimal route between the data source and the at least one electronic device allocated to the corresponding component; and

routing each of the allocated components in the multi-channel message according to the selected communication paths for presentation of the allocated
20 components by the corresponding electronic devices.

2. The method of claim 1, wherein the step of determining possible communication paths comprises the steps of:

designating one of the communication links as an input communication link over which to receive the multi-channel message from the data source;

25 designating one of the electronic devices as a destination device for presenting one of the components in the multi-channel message;

evaluating whether a communication path exists between a first electronic device, the first electronic device being connected to the input communication link, and a second electronic device;

when a communication path exists between the first and second electronic devices, determining substantially all possible communication paths between the second electronic device and the destination device not including the first electronic device; and

repeating the steps of evaluating whether a communication path exists and
5 determining possible communication paths for each of the electronic devices in the connection arrangement except for the first electronic device, wherein another one of the electronic devices that has not been evaluated is substituted for the second device.

3. The method of claim 2, wherein the step of determining the communication paths further comprises associating an indication with each of the
10 possible communication paths.

4. The method of claim 3, wherein the indication associated with a given one of the communication paths represents at least one of: (i) each of the electronic devices comprising the given communication path; and (ii) each of at least one intervening communication link comprising the given communication path.

15 5. The method of claim 2, wherein the step of determining the communication paths further comprises generating an output list comprising substantially all possible communication paths between each electronic device and the destination device, not including the first electronic device.

6. The method of claim 1, wherein the step of selecting the communication
20 paths for the allocated components comprises:

for each allocated component in the multi-channel message, determining a latency associated with each of the possible communication paths in the connection arrangement corresponding to the allocated components; and

selecting communication paths for the allocated components such that the
25 latencies associated with each of the selected communication paths are substantially matched to one another.

7. The method of claim 1, further comprising the step of at least temporarily storing information relating to the possible communication paths between the data source and the electronic devices allocated to the corresponding components in the multi-channel message.

5 8. The method of claim 1, wherein the step of selecting the communication paths for the allocated components comprises, for a given allocated component in the multi-channel message:

receiving a plurality of possible communication paths between the data source and the at least one electronic device corresponding to the given allocated component;

receiving at least one characteristic associated with the plurality of possible communication paths;

determining a set of aggregate attributes corresponding to each of the plurality of possible communication paths;

15 comparing the set of aggregate attributes for the plurality of possible communication paths; and

determining, based at least in part on the at least one characteristic associated with each of the plurality of possible communication paths, an optimal communication path for the given allocated component.

20 9. The method of claim 8, wherein the set of aggregate attributes corresponding to a given one of the plurality of possible communication paths comprises characteristics associated with at least one communication link included in the given one of the plurality of possible communication paths.

10. The method of claim 9, wherein the characteristics associated with the at least one communication link comprises at least one of power of the at least one link, an estimate of link latency, a distribution of link latencies, an estimate of a bandwidth of the

at least one link, and a number of dropped packets on the at least one link as a proportion of a number of packets sent on the at least one link.

11. The method of claim 1, wherein the data source comprises at least one of the plurality of electronic devices in the connection arrangement.

5 12. The method of claim 1, wherein the data source comprises the Internet.

13. The method of claim 1, wherein the selection criteria comprises latency.

14. Apparatus for presenting a multi-channel message originating from a data source, the multi-channel message comprising a plurality of components, the apparatus comprising:

10 at least one controller operative to: (i) allocate each of at least a portion of the plurality of components in the multi-channel message to at least one electronic device for presentation to a user; (ii) for each allocated component, determine possible communication paths between the data source and the electronic device allocated to the corresponding component; (iii) select, based at least in part on one or more selection
15 criteria, at least one of the possible communication paths for each of the allocated components, each of the selected communication paths representing an optimal route between the data source and the at least one electronic device allocated to the corresponding component; and (iv) route each of the allocated components in the multi-channel message according to the selected communication paths for presentation of
20 the allocated components by the corresponding electronic devices.

15. The apparatus of claim 14, wherein the controller is further operative to:
(v) designate one of the communication links as an input communication link over which to receive the multi-channel message from the data source; (vi) designate one of the electronic devices as a destination device for presenting one of the components in the
25 multi-channel message; (vii) evaluate whether a communication path exists between a

first electronic device, the first electronic device being connected to the input communication link, and a second electronic device; (viii) when a communication path exists between the first and second electronic devices, determine substantially all possible communication paths between the second electronic device and the destination device not including the first electronic device; and (ix) repeat the steps of evaluating whether a communication path exists and determining possible communication paths for each of the electronic devices in the connection arrangement except for the first electronic device, wherein another one of the electronic devices that has not been evaluated is substituted for the second device.

10 16. The apparatus of claim 15, wherein the controller is further operative to associate an indication with each of the possible communication paths.

15 17. The apparatus of claim 15, wherein the controller is further operative to generate an output list comprising substantially all possible communication paths between each electronic device and the destination device, not including the first electronic device.

18. The apparatus of claim 14, wherein the controller is further operative to: (v) determine a latency associated with each of the possible communication paths in the connection arrangement corresponding to the allocated components; and (vi) select communication paths for the allocated components such that the latencies associated with each of the selected communication paths are substantially matched to one another.

19. The apparatus of claim 14, wherein, for a given allocated component in the multi-channel message, the controller is further operative to: (v) receive a plurality of possible communication paths between the data source and the at least one electronic device corresponding to the given allocated component; (vi) receive at least one characteristic associated with the plurality of possible communication paths; (vii) determine a set of aggregate attributes corresponding to each of the plurality of possible

communication paths; (viii) compare the set of aggregate attributes for the plurality of possible communication paths; and (ix) determine, based at least in part on the at least one characteristic associated with each of the plurality of possible communication paths, an optimal communication path for the given allocated component.

5 20. The apparatus of claim 19, wherein the set of aggregate attributes corresponding to a given one of the plurality of possible communication paths comprises characteristics associated with at least one communication link included in the given one of the plurality of possible communication paths.

10 21. The apparatus of claim 14, wherein the apparatus is implemented at least in part in a semiconductor device.

22. An article of manufacture for presenting a multi-channel message originating from a data source, the multi-channel message comprising a plurality of components, the article of manufacture comprising a machine readable medium containing one or more programs which when executed implement the steps of:

15 allocating each of at least a portion of the plurality of components in the multi-channel message to at least one electronic device for presentation to a user;

 for each allocated component, determining possible communication paths between the data source and the at least one electronic device allocated to the corresponding component;

20 selecting, based at least in part on one or more selection criteria, at least one of the possible communication paths for each of the allocated components, each of the selected communication paths representing an optimal route between the data source and the at least one electronic device allocated to the corresponding component; and

 routing each of the allocated components in the multi-channel message
25 according to the selected communication paths for presentation of the allocated components by the corresponding electronic devices.